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ESMAP

Energy Sector Management Assistance Programme

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Côte d'Ivoire

**Project of Energy Efficiency
in Buildings**

Report No. 175/95

**JOINT UNDP/WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)**

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) is a special global technical assistance program run by the World Bank's Industry and Energy Department. ESMAP provides advice to governments on sustainable energy development. Established with the support of UNDP and 15 bilateral official donors in 1983, it focuses on policy and institutional reforms designed to promote increased private investment in energy and supply and end-use energy efficiency; natural gas development; and renewable, rural, and household energy.

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COTE D'IVOIRE

PROJECT OF ENERGY EFFICIENCY IN BUILDINGS

SEPTEMBER 1995

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and Household Fuels Division
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ACRONYMS

ACDI	I'Agence Canadienne de Developpment International
ADEME	Agence de l'Environnement et de la Maitrise de l'Energie
BAD	Banque Africaine de Developpement
BEE	Bureau des Economies d'Energie
BEMS	Building Energy Management System
BSIE	Budget special d'investissement et d'equipement
CMA	Chalifour, Marcotte et Associates
CORDINORM	Comite Ivoirienne d'Electricite
CFD	Cassie Francais de Developpement
CIE	La Compaigne Ivoirienne des Electricite
CITAD	La Cite Administrative
DCGTx	La Direction et COntrole de Grand Travaux
DCU	La Direction de la Construction et de L'Urbanisme
EECI	Energie Electrique de Cote D'Ivoire
EMC	Energy Management Committees
ENSTP	L'Ecole National Superieure de Travaux Publics
ESMAP	Energy Sector Management Assistance Program
ETSU	Energy Technology Support Unit
FEM	Fonds de l'Environment Mondial
FDFP	La Fonds du Development pour la formation Professionnelle
GEF	Global Envirnement Facility
LANEMA	Laboratoire National de l'Environment et de Metrologie
LBTP	La Laboratoire du Batiment et des Travaux Publics
IBRD	The World Bank
IEPF	Institut de l'Energie des Pays Francophones
INSET	Institut National Superieur de l'Enseignement Technique
MECU	Ministere de l'Environnement, de la Construction et de l'Urbanisme
MEF	Ministere de l'Economie et des Finances
ODA	Overseas Development Association
PEEB	Project of Efficient Energy in Buildings
PNEE	National Program for the Economies of Energy
PMS	Preventive Maintenance System
SECTOR	Service de Controle des Installation Electriques Interieures
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UPACI	La Union Patronale de Cote D'Ivoire
USAID	United States Agency for International Development

ABBREVIATIONS

Kwh Kilowatt hour
MW Megawatt
Gwh Gegawatt hour

Exchange Rate

1USDollar = 250 FCFA

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A. PURPOSE

1. The purpose of this ESMAP Activity Completion report is to present a concise account of the activities and recommendations of the Project of Efficient Energy in Buildings (PEEB) in Cote D'Ivoire. The project was undertaken by the joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP), working in collaboration with Ministry of Mines and Energy, in particular the Bureau of Energy Efficiency (BEE).¹ The report focuses on the survey of energy consumption of large buildings, the new building codes and activities proposed by the recommendations of the project. The survey was carried out with funds from l'Agence Canadienne de Developpement International (ACDI).

B. BACKGROUND

2. Prior to the commencement of this project (PEEB) Cote D'Ivoire had put in place various actions in the domain of control of energy, in particular, the Bureau of Economy of Energy, a National Plan of Energy in 1991,² a diagnostic survey of existing buildings; a program to rectify the energy billing system (not rectified since 1986); programs to determine the optimal conditions for the work environment; maintenance contract with clauses to favor the window type air conditioners; and several public enlightenment programs in energy economy.

3. BEE was created in 1986 through the national campaign to conserve energy and improve energy use efficiently. BEE, which is an arm of the Hydrocarbon and Energy division of the Ministry of Industry, Mines and Energy. Its principal tasks are:

- (a) management of energy in public sector to reduce state spending;
- (b) support for energy efficiency in industry, to reduce energy cost and improve competitiveness;
- (c) management of biomass to improve utilization of national forest and agricultural residues.

In 1986 the identified targeted savings was 10 million FCFA per annum, whilst the current yearly savings realized is 3 million FCFA.

¹ This activity was executed by an ESMAP team which comprised of: Mr. Philippe Durand (ESMAP- Task Manager), Messers Chalifour, Marcotte and Associates (Experts/Consultants, B. E. Staniaszek and A.E.D. Wilson (Consultants - ETSU). The Activity Completion Report was prepared by Philip Adams (Consultant).

² Plan National de l'Energie, presentation et syntheses, DCGTx, Octobre 1991.

4. It was noted from local studies that the use of air-conditioning accounted for about 30% more in the nation's consumption.³ With this and other factors such as the substantial savings which could be realized, the proposed energy policy was primarily to aim at a more efficient use of electricity and to have the optimum management in place to meet the needs. Cote D'Ivoire sought the assistance of ESMAP and the PEEB was initiated.

5. The work undertaken between July 1990 and March 1993 under PEEB, included series of pilot energy surveys of administrative buildings, extension of pilot project to certain buildings in Cote D'Ivoire and preparation of energy efficiency code. The Energy Technology Support Unit (ETSU) in UK, in conjunction with a staff of ESMAP carried out a work review. This evaluation was accomplished through review of reports and one week's visit to Cote D'Ivoire in January 1993.⁴

C. OBJECTIVES AND SCOPE OF STUDY

6. The primary objective of PEEB is to assist the republic of Cote D'Ivoire to work with national institutions, in particular, the Bureau of Economy of Energy (BEE), in pursuit of programs for the control of energy in the sector of modern administrative, commercial and residential buildings. The PEEB project was designed to:

- (a) carry out diagnostics to identify the potential energy savings;
- (b) achieve the realization of the pilot project of the energy economy through the survey of large buildings;
- (c) put in place the mechanism of creating funds to determine or assume the perpetual and automatic development of economies of energy in large buildings;
- (d) propose an Ivorien code of quality energy for buildings;
- (e) prepare an Ivorien code of comfortable temperature of non-air-conditioned environment; and
- (f) improve energy control and management in the area of public lighting.

³ Compte rendu du diagnostic de 26 établissements du secteur tertiaire, Jean Thibon, Novembre 1987.

⁴ Critical Success Factors For Energy Efficiency Strategy Development For Commercial Sectors: Case Study- Cote D'Ivoire Building Energy Efficiency Project. ETSU, March 1993.

D. OVERVIEW OF TECHNICAL REPORT

The main text of the report is structured as follows:⁵

Chapter 1 -- Reviews the energy sector , the strategies being employed for energy control and the electrical production and demand patterns.

Chapter 2 -- Reviews the control of energy in Cote D'Ivoire. It classifies the building in terms of their function and usage, and gives a picture of the consumption pattern. It gives the strategies employed to control energy in buildings, the players and their responsibilities and actions, as well as the objectives of the project in buildings.

Chapter 3 -- Reviews the Projection of Energy Efficiency in Building, (PEEB), in terms of general objectives of the pilot operation, choice of building for the pilot project survey, the diagnostics, applications of the recommended standards or actions, the teaching and lessons of the project and the extension of the pilot project.

Chapter 4 -- Reviews the code of energy quality in buildings in terms of the objectives , justification, international experiences, the local construction market, available professional services and institutions. It elaborates on the project for the Ivorien code for the quality of energy of buildings and comfort of the non air-condition environment.

Chapter 5 -- Analyzes and reviews the energy economy in public lighting, the stakes in the programs and the costs of initiating these programs.

Chapter 6 -- States the conclusion of PEEB and perspectives in terms of the teachings and constraints, recommendations for improving environmental techniques and institutions, as well as recommendations for the large programs to be brief or with term limits.

E. MAIN FINDINGS OF TECHNICAL REPORT

The Energy Sector (Chapter 1)

7. There are 3 principle sources of energy: hydro-electricity (17%); petroleum products (34%); and biomass (48%). Electricity supply in Cote D'Ivoire

⁵ Final Report - Project of Efficient Energy in Buildings (PEEB) - Cote D'Ivoire, ESMAP, 1993.

comes from hydro-electricity(62%), thermal power (23%) and imported from Ghana (15%). In 1989/90 210 GWh was distributed through the national grid. The problems in meeting this level of demand are, the low availability of the thermal plant, rainfall patterns for the hydroelectric plants, and cost of imported energy which is unreliable. The national energy plan is looking at numerous options to boost production and obviate import. Abidjan consumes 60% of the total electricity produced.⁶

8. The primary objective of PEEB was to assist the republic of Cote D'Ivoire to work with national institutions, in particular, the Bureau of Economy of Energy (BEE), in pursuit of programs for the control of energy in the sector of modern administrative, commercial and residential buildings.

9. The building sector was classified in 3 large categories based on energy consumption:

- (a) Economy building in which 190,000 residences were recorded to consume an average of 60 Kwh per month;
- (b) Modern buildings, generally with air conditions in which 225,000 installations were recorded to consume an average of 300 KWh per month;
- (c) Large buildings, (800 total, of which 550 belong to the public sector) of tertiary sector are generally concentrated in Abidjan and Yamoussoukro, consume over 25% of the national energy demand.

10. The principal layers on energy economies accessible without investment concern the improvement of the administration or management of air-conditioners and lighting. The potential of energy savings accessible is estimated at 200 GWh per year, for the total existing building, and the public lighting, which accounts for 10% of the national consumption of electricity. The large buildings in particular, those of the public sector, use up an important part of the national consumption, and thus require high priority.

11. The effectiveness of energy management in the large building is mediocre, resulting from bad choice of equipment, and lack of adequate technical capability among other things. However, estimates indicated that total modification on existing building is not cost effective.⁷ Considering the scarce resources for capital budgeting, only energy management improvement is considered feasible and was recommended.

12. The application of an effective energy code for renovated existing buildings could lead to an improved energy economy of 20% by reference of the present

⁶ Economies D'Énergie en Cote D'Ivoire; Evaluation and Programme, November 1985.

⁷ Rapport General - Etude d'économies dans CCIA, CITAD, ENSTP (CMA 1991).

condition. In the economy buildings, the criteria for climatic design were ignored, and this resulted in an uncomfortable thermal environment. The solution was resorting to air conditioning.

13. The adoption of a code for a comfortable environment of non air-conditioned building would limit the recourse to air-conditioning.

14. The policies for energy control must target the following objectives:

(a) In large buildings and residence of status, the program of energy control must attach priority to:

- (i) improving quality of energy management;
- (ii) improving the efficiency of the working facilities;
- (iii) promoting the design of the new building by presenting a high level of quality energy management for the building envelopes and facilities.

(b) In the economy residential buildings, the policy for energy control should seek to improve the natural comfort by good design of the residence for adequate ventilation, with the goal of limiting the use of air-conditioning.

Energy Control in Cote D'Ivoire (Chapter 2)

15. The problem of the energy control in building in Cote D'Ivoire centers on three principal concerns:

- (a) **Standardization**, which is an important part of the management of energy economy, hinges on the replacement of existing equipment with better performance to optimize the behavior of energy usage in the buildings;
- (b) **Demonstration** of the potential for economical operation, particularly, in the public sector, which generally has large wastage of energy;
- (c) **Incentives** for decision makers and users (in particular the private sector), to have interest in energy economy.

16. In general, these concerns could be addressed in the light of:

- (a) sensitizing decision makers, owners and users to justify the well founded economical principles and ethics for energy economy;
- (b) setting appropriate educational programs for usage by the operators, the methodology of the work entailed, and managing the behavior and technology of energy economy;

- (c) installation of the mechanism and financial plan aiming at long-term activities for energy economy.

17. With regard to these issues a diagnostic survey was carried out prior to PEEB in 26 large buildings in 1987, and BEE had defined the outline of the measures to be included in the strategies for energy control.⁸

The Actors

18. The actors are involved in different stages in the formulation, execution, supervision and evaluation of the activities of the energy control in the buildings.⁹

19. The organizational institution: is confined to the Ministry of Mines and Energy, in particular, the division of Hydrocarbon and Energy, under the sole direction of the Bureau of Economy of Energy.

20. The environmental policy coordination is confined to the Ministry of Environment, Construction and Urbanization through the division of Environment.

21. The primary education policy is confined to the Ministry of National Education, whilst training is confined to the Ministry of Superior Training and Scientific Research through the l'Ecole Nationale Superieure des Travaux Publics (ENSTP).

22. The main operators are :

La Bureau des Economies des Energie (BEE)
La Laboratoire du Baitment et des Travaux Publics (LBTP)
L'Ecole National Superieure de Travaux Publics (ENSTP)
La Direction et Controle de Grands Travaux (DCGTx)
La Compaigne Ivoirienne des Eclectricite (CIE)
La Direction Generale du Budget
La Direction de la Construction et de l'urbanisme (DCU)
La Direction de L'Environement
La Service Autonome de la Normalization
La Union patronale de Cote d'Ivoire (UPACI)
La Fonds du Development pour la Formation Professionelle (FDFP)

23. The need for administration of energy caught the attention of the government in 1983/1984. In 1984, the Chef l'Etat, with a view to reducing expenses on electricity in the public sector made the first public decision on the control of energy. The National Program for the Economies of Energy (PNEE) was prepared in conjunction with

⁸ Compte rendu du 26 etablissements du secteur tertiaire, Jean Thibon, Novembre 1987.

⁹ Actes de l'atelier sur la maitrise de l'energie dans les batiments, ESMAP/BEE, 26-28 Juin 1991.

bilateral and international agencies (USAID, FAC, ACDI, UNIDO). This program was confined in BEE, and in 1986, the division of Energy and Infrastructure was created in the Ministry of Industry and Planning .

24. The objectives of the program for energy control was defined in different ways, based on the parameters:

- (a) In the modern tertiary sector the policy is improvement in administration of energy, equipment performance, and temperature environment;
- (b) In economy building sector the policy is the improvement of natural temperature through the design of buildings.

25. The functions of PEEB preoccupying the government are the analyses and activities that will reduce the public expenses in the large buildings in the public sector, to identify the potential savings in economy without investment, considering the limited resources in the capital budget.

Pilot Project of Energy Economy in Administrative Building (Chapter 3)

26 The pilot operation was necessary to confirm the potentials of energy economy savings, identify the priority measurements and the obstacles of the work.

27. The objectives of these activities are to:

- (a) demonstrate the feasibility of technology and economics of the program of energy efficiency in administrative buildings;
- (b) prepare a general measurement for profit-earning and the impact of selection of principal building in public and private sectors;
- (c) prepare a detailed format of methods and procedures to implement the measures for energy economy by Ivorien engineers.

28. The criteria for the choice of buildings to be used in the pilot project are:

- (a) the level of electricity consumption;
- (b) the two principal types of administrative building used for offices and advance learning;
- (c) the two principal types of facility maintenance, one carried out in-house, and the other confined to a service company;

- (d) the two principle types of administration of billing method for electricity; centralized billing and payment, and decentralized billing (autonomous budgeting).

29. The major obstacles from the project reports are categorized as follows.¹⁰

Institutions

- lack of obligatory measures and difficulties of applying them, where present.
- non-payment of electricity bills by State, which creates no incentive for energy efficiency.
- BEE does not have adequate skills or means to carry out the role effectively.

Technical

- Much technological support is by foreign organization.
- Majority of equipment or materials imported presenting maintenance problems.

Financial

- Low liquidity in most organizations.
- Poor state of public finances.
- High cost of imported technology and lack of financial incentives.
- Inflexibility between capital and expenditure budgets.

30. The principal building consumers of energy belong to the public sector. The cost for initial choice to conduct some of exploration work and maintenance was very high and incompatible with the present resources of the state. This was an indication of the typical situation of under-budgeting of maintenance expenses leading to degradation of equipment in most cases.

31. In the buildings concerned by the pilot project, the cooling system of some groups were inappropriate. Rehabilitation of these was necessary to achieve some measures of preventive upkeep in terms of energy efficiency. This could not be achieved due to lack of financial resources, lack of adequate standardization, and poor design resulting in wastage of irretrievable energy.

32. At the technical level, some facilities are subjected to exploitation and the complexity of maintenance. This is common in the public sector, where the agents of

¹⁰ Rapport general project pilote, Pierre Marcotte et Cackpo Codjo, 20 May 1991.

maintenance deliberately withhold information about the character of the work involved maintenance of facilities. In this context, the implementation of the optimal management for energy savings should include computerized maintenance system, or centralized technical management for users to be better informed.

33. It was noted that these obstacles are beyond the scope of an efficient energy program. However, areas with possibilities for improvement should be explored. Activities aimed at improving information dissemination, which are highly cost effective, and can simulate the adoption of no and low cost measures (with excellent returns) should be considered for implementation.

34. The Canadian experts Chalifour, Marcotte et Associates (CMA) proposed that, a solution to these problems was to have a committee for the administration of energy in every establishment, thus the organization of Committees for Management of Energy (EMC) was created. The experience uncovered 80% of the administration of energy economies that does not necessitate investment. Hence, the activities of the committees of administration of energy were especially gratifying. It was proposed that, the EMCs should have 4 or 5 key members out of the 10-12 members, to ensure continuity and frequency of meeting be held quarterly. It is important to bear in mind that, energy savings programs should not be counterproductive, and so programs should be practicable and kept simple.

35. PEEB analysis on government buildings revealed that 15% savings could be realized at no cost, and a further 15% savings is possible with a pay back period of 3 years. The total would mean a savings of 2 billion FCFA per year.

Results Achieved by Pilot Project

36. The surveys revealed the opportunities for further action in the following areas, to improve or alleviate the constraints and obstacles:¹¹

- Establishment of Energy Management Committees (EMC).
- Development of effective Preventive Maintenance Systems (PMS).
- Training of building administrators, managers and technical staff.
- Development/testing of shared savings schemes.
- Feasibility installation of a Building Energy Management System (BEMS) at ENSTP

¹¹ Ibid.

Preventive Maintenance Systems

37. Contracting companies have been encouraged to set up planned maintenance schedules for both public and private sector buildings. There is considerable interest in computerized maintenance programs.

Training

38. Training is considered an important tool of any energy savings program. In 1988, prior to the ESMAP program, BEE had published technical brochures on several topics. During the ESMAP program, two training workshops were held, and it was noted that a third of the participants had implemented some of the no cost measures.

Shared Savings Scheme

39. The idea has been implemented through an agreement in which the maintenance contractor, GOGIM entered with the administration of CITAD. The contract period is for 5 years, and in the trial version COGIM gets 25% of any savings achieved. It was noted during the evaluation that, the contract has had mixed success due to lack of commitment by the CITAD administration. This created little incentive for COGIM to meet a contractual obligation.

BEMS at ENSTP

40. The installation of BEMS at ENSTP as a pilot demonstration of technology which could be used as a national training aid was studied under the PEEB program. It was estimated to cost \$270,000 with a potential savings of US\$ 202,000 (pay back of 1.4 years). Although the return on investment was excellent, funds were unavailable from both original ESMAP program and l'Agence Canadienne pour le Developpement International (ACDI). There is a probability of this to be undertaken through additional work to be funded by the Global Environment Facility.

41. PEEB focused on the measurement of weak areas, and the diagnostics showed the sample for potential of energy economy, where the evaluation for the total of seven buildings is more than 12Gwh, which is well over 35% of the annual electrical consumption. Most of the measures recommended carrying out improvement of installation, and equipment, rather than heavy investment.

42. The reports of the analyses of energy revealed many problems stemming from organization, material and technology for the realization energy efficiency. It revealed that the implementation measures commended by the diagnostics will be ineffective if the adequate environment is not created.

43. The solutions proposed for the extension of the pilot project were:
- (a) selection of the buildings which make use of installations from the good energy efficiency market;
 - (b) include the programs of global rehabilitation of public buildings.

The Project of Code of Energy Quality of Buildings (Chapter 4)

44. The general objective of this activity hinges on PEEB to promote a dynamic program for the improvement of energy compartment in new or renovated buildings.

45. This activity of PEEB was carried out in two areas:¹²
- (a) the elaboration of the project of Ivorien code of quality energy of buildings designed with air-conditioning, and the definition of the conditions of their application;
 - (b) the elaboration of a code of thermal comfort of the residences intended without air conditioning.

46. The code of energy quality of buildings is a reference document for the design and the development of economical building in energy. Its application is to buildings of areas greater than 100m². The preparation of codes of energy quality is new to the African plan. It is a new approach to conception of buildings, but limits the obligation of application to the time of the construction, or large renovations of buildings.

47. The code of thermal comfort of non-air-conditioned buildings aims principally to control public work and to serve as a reference document during the construction of new projects and extension to buildings, which are not designated to have air-conditioning mechanism. The utilization of this code will create measures for obtaining acceptable conditions of comfort without the utilization of air-conditioning mechanisms. The popularization of the code will be the trade-off to escape the cost of installation of air-conditioning systems, energy wastage and maintenance.

48. The preliminary versions of the code and the guidelines for the application were realized under the coordination of L'Ecole Nationale Supérieure Travaux Publics of Yamoussoukro.¹³ The code includes two types of prescriptions: (a) the provisions required, and (b) the criteria of performances to yield the principal factors, which will determine the permitted temperature of the building.

¹² Reports no 13 through 29 during PEEB, 1990-1993.

¹³ Project de code ivoirien de qualite thermique de l'habitat, Version 1, March 1993.

49. The method for elaborating the project for the code of energy quality for buildings requires putting in place the mechanism to understand the two phases for implementation: the technical phase and the institutional phase.

50. Work was undertaken jointly by BEE, the Laboratoire du Baitment et des Travaux Publics (LBTP) and ENSTP. The code covers building fabric, air-conditioning and ventilation, lighting, domestic hot water provision and other electrical services. Although, its initial impact will be modest, with only 1 to 2 new buildings per year, it will be promoted through a series of guidelines to existing buildings. Users with a view to defining operational parameters, such as minimum temperature, would propose set points for air-conditioned spaces.

Energy Economy in Public Lighting (Chapter 5)

51. On the margin of specific activities devoted to the buildings, BEE demanded that a study appropriate for the control of energy on public lighting be taken within the framework PEEB.¹⁴

52. The domain of public lighting is of the order of 150,000 points, with an annual consumption of 80,246,000 Kwh in 1990, corresponding to 20% of the public sector consumption. The load connected to this was 35.8 MW, which represented 10% of the roll of power in the network. The cost for total annual consumption went up to 3.77 billion FCFA.

53. The strategy employed for the realization of energy economy in the project was the program of conversion of mercury lighting bulbs above 250 watts to sodium. The program will be carried out on 80,000 light bulbs, 5000 in the first year and 25,000 in the following three years. The cost of one of the programs is estimated to be 8 billion FCFA.

54. The energy economy generated by the program is estimated at 2,763 billion FCFA per year. Over a period of 15 years, the project will free the economy of 17.4 billion FCFA net.¹⁵

55. The parallel to the above program is the proposed testing of pilot program of 500 lights, with energy economy electronic decentralized mechanism (electric power variator), in order to evaluate the viability in tropical climate and the impact in energy consumption.

56. The survey achieved in the setting of PEEB, revealed a potential theoretical savings of 130 Gwh per year, resulting from the substitution of the mercury

¹⁴ Reports no 6 and 7 during PEEB, 1990-1993.

¹⁵ Final Report - Project of Efficient Energy in Buildings - Cote D'Ivoire, ESMAP, 1993, P84.

lamps by some sodium. It recommended a program of substitution of 80,000 lamps greater than 250 watts, meaning a total of 8 billion FCFA and yearly savings of 2.76 billion FCFA.

57. The stake for such programs, however, necessitates an improvement of the institutional environment through the management by:

- (a) having a realistic budgeting depending on the lighting system;
- (b) rehabilitating the lighting system to a more cost effective system;
- (c) having collective local responsibility;
- (d) designating a sole administrator responsible for public lighting.

58. It was noted in the findings of PEEB, that, most of the large buildings were inappropriately designed and that very little use was made of daylighting in the design, although more recent buildings are making use of the more efficient 26 cm fluorescent lamps.

F. OVERVIEW OF REVIEW WORK (BY ETSU)

59. ESMAP initiated the review work on PEEB using an independent consultant with the principal aim of:

- (a) determining in concrete terms the extent to which the objectives of PEEB had been achieved, access the results and the impact of the consultants used;
- (b) arriving at a better understanding of the manner in which energy economy measures were selected and implemented;
- (c) identifying the main barriers in this project and make recommendations for the replication of the pilot project and future of energy efficiency in Cote D'Ivoire; and
- (d) providing information from the result of the experience, to target ESMAP's activities on energy economy in Cote D'Ivoire in particular, and other recipient countries.

60. The review work was supported by the Overseas Development Administration (ODA) of the United Kingdom.¹⁶ The work is carried out by the Energy Technology Supporting Unit (ESTU) in UK as principal Consultant.¹⁷

The Review

61. The present review work examines the structure of the Project of Energy Efficiency in Buildings (PEEB), in terms of the role of BEE (the main operator), the objectives of PEEB and the main activities conducted between July 1990 and March 1993. It was noted that these activities were carried out by local staff with support and training from Chalifour, Marcotte and Associates (CMA), a French Canadian consulting firm.

62. The use of energy in Cote D'Ivoire was reviewed in the light of the problem of each source of supply. It was noted that the National Energy Program (NEP) is looking at several options to boost local production and reduce imports of electricity and fuel. The fact that the Abidjan area alone consumes 60% of the total demand was considered significant.

63. In the review of the non-residential building sector, it was observed that 25% of the national consumption of electricity was from the public sector with over half been consumed by a total of 60 buildings. Furthermore, it was concluded that during conceptual stage emphasis was more on architectural style and high level service rather than design for energy efficiency which takes into account, climatic condition, building envelopes and layout to maximize solar gains.

64. The priority tasks of BEE were reviewed and it was noted that the targeted savings of 10 million FCFA per year identified in 1986 is still far from being attained. The current savings being realized is about 3 million FCFA.

65. The barriers to the effort in meeting the objectives in energy economies were categorized under institutional inadequacy, low local technical capabilities and poor financial resources.

66. The results achieved in PEEB wer noted as the pilot project in 7 major buildings, training of local personnel for energy efficiency, in particular for techniques and approach in energy surveys, and opportunities highlighted by the survey of the pilot project for further action (which are detailed in the overview of the technical report).

¹⁶ Also included in the review was the identification and development of practical tools and criteria, in particular Critical Success Factors (CSF), which in future would be the pivot for ESMAP's efforts to translate energy efficiency strategy and capacity building in recipient countries into reality. Evidence to justify CSF is being collated through the preparation of a series of case studies.

¹⁷ Case Study - Cote D'Ivoire Building Energy Efficiency Project, ESTU, March 1993.

67. Since the concerned buildings were constructed between late 1970s and early 1980s it is unlikely that external refurbishment will be done in the foreseeable future, hence the survey was focused on measures for air conditioning, lighting and other electrical services and not major external fabric.

68. The building energy efficiency code was observed to be directed at building energy requirements for tropical climates and made extensive use of similar codes developed for Jamaica and South East Asia.

69. The code will stipulate design requirements for minimum fresh air limits and methods for evaluating daylight savings opportunities. The recommended figures based on research data on comfort conditions acceptable to building occupants which the code will stipulate in future are:

- the southern tropical zone 24-25°C, 65% rh,
- the central intermediate zone 25-26°C, 60% rh,
- the northern dry zone, 26-27°C, 60% rh.

70. Experts at ETSU have noted that the demonstration of a nearly example built in accordance with the code and subjected to independent monitoring, as well as a user acceptance assessment, could be used as a vehicle for promoting code and guidance material. †

G. CONCLUSIONS AND RECOMMENDATIONS

Technical Report (Chapter 6)¹⁸

71. The development of the activities of energy control is curbed by the multiple obstacles and constraints in terms of technical, economic and institutional, among others.

72. In the technical context, one important part is the wastage of energy resulting from poor conception and bad design of the buildings not adaptable to the environmental climate; certain choices of technology ambiguous and difficult to manage; the scarcity of public resources; consequences of degradation of equipment, and the development of autonomous energy services limited to the dimensional structure of the local market.

73. Regarding the institutional constraints, the economy of commercial energy in the private sector does not constitute a priority in the national plan, and the activities of

¹⁸ Final Report - Project of Efficient Energy in Buildings - Cote D'Ivoire, ESMAP, 1993.

energy control in buildings suffer from a lack of coordination, and the principal interveners of the electrical sector interested in promoting the policies of energy control.

74. In addition, the users of energy does not constitute the pressure organization capable of making an impact on energy economy, the human resources are grossly inadequate, and the informal sector is a difficult ground for implementation of energy economy technology.

75. The recommendations are geared towards the improvement of technologies and institutional orders which would permit the creation of an environment, more favorable to the development of activities of the control of energy in the buildings, among others. The principal actions recommended to be carried out could be summarized as follows: (a) the improvement of technical and institutional environment with the aim of raising or attenuating the constraints mentioned during the funding of the project; (b) the development of the experience acquired through PEEB, and (c) the development of measurement of the accompaniment to ensure efficiency energy management or control. The résumé and organization of the activities are summarized in Board 1.

Review Work¹⁹

76. The review work concluded that each area has had some degree of success, in particular the area of training. Promotion of the other activities can be effectively carried out through writing up and publishing of case studies. Promoting the case studies, as well as, the building energy efficiency code, to neighboring countries with similar climatic conditions is appropriate. The replication will provide effective use of ESMAP funds and reduce learning time for new approaches in those countries.

77. Regionally, this approach could create a larger market for energy efficiency equipment and services and encourage suppliers to establish bases in the region.

78. In particular, through the dissemination process Cote D'Ivoire could become a regional center in the domain of energy efficiency, providing training, advice and information to neighboring countries. This could lead to a significant in-flow of money.

79. Regarding BEMS and lighting control in Cote D'Ivoire (with a much smaller market). Suggestions are, that a small number of projects (about 5 in number) through BEE could signal to equipment suppliers the government's commitment to see the market develop and provide the stimulus for skills development for the subsequent

¹⁹ Case Study - Cote D'Ivoire Building Energy Efficiency Project, ESTU, March 1993.

replication phase. Independent monitoring will develop analysis capabilities in organizations like LBTP.

H. THE FUTURE OF ENERGY EFFICIENCY IN COTE D'IVOIRE

80. The impact of the present work through PEEB has been pressure to reduce electricity consumption and fuel/electricity imports. A further US\$3.5 million UNDP-GEF funded project (Building Energy Efficiency Regional Project) is proposed. This will aim at controlling greenhouse gas emission through energy efficient technology.

Extension of Pilot Project

81. The future of energy efficiency in Cote D'Ivoire lies in the extension of the pilot project and the subsequent replication both locally and regionally. The maximum benefit from the pilot project work could be obtained through a well planned dissemination program. The planning must recognize the nature of the replication market and products available for marketing.

82. ESTU noted that, in any program for replicating the present work and further developing of new projects, the following issues must be addressed to overcome the barriers in Cote D'Ivoire:²⁰

- Relevance of macro and firm level environment considering the current economic situation in Cote D'Ivoire.
- Levels of awareness and technical capacity, although an initial evaluation report in November 1985 revealed no appreciation of energy management, or opportunities for cost saving; the general level of engineering competence in Cote D'Ivoire is relatively high.
- Electricity pricing policies have not changed since 1984, but are comparably high. The attitude of the electricity supply industry to energy conservation is neutral, but they cooperate with LBTP, by providing statistics used to analyze consumption, resulting in industry savings of 2,000 million FCFA annually through tariff adjustments.
- Institutional frame work, where there is a lack of clearly autonomous intermediary, to promote and coordinate the delivery of energy efficiency by various actors, where they have comparative advantage. BEE is

²⁰ Case Study - Cote D'Ivoire Building Energy Efficiency Project, ETSU, March 1993.

attempting to fulfill the twin role of policy setting and program management.

- Budgetary constraints, such as the economic situation, indicates that the resources for significant capital investment are very limited.
- Market of private delivery of energy service is lean; it consists of two main French subsidiary maintenance companies, together with a number of smaller companies. In terms of private consultancy, there appears to be only one, based in Abidjan.
- Obligatory/Advisory mechanisms are necessary, as initially the proposed building efficiency code will be obligatory mechanism in the medium term, but alongside the code, will be a series of advisory guides to give existing building operators guidance to achieving energy savings.

83. Cote D'Ivoire should endeavor to implement these recommended measures in order to remove the barriers to achieving energy efficiency and the much needed savings, through the replication on the pilot project. The activities to be undertaken should be scheduled under a more precise time frame. In allocating resources, priority should be given to these activities.

84. The market in Cote D'Ivoire has been categorized by BEE in an initial analysis of electricity usage by sector. Of the total consumption of 685 GWh, 48% is for air-conditioning, 33% lighting and 19% other services. However, considering that large buildings concentrate on air conditioning, 62% of usage becomes a target for a focused program of energy efficiency improvement.

The Products

85. ETSU noted that, successful marketing of energy efficiency in UK and OECD countries relies on effective dissemination of good quality information. The initiatives acquired through the PEEB pilot program have been:²¹

- Operations of energy management committees.
- Preventive maintenance systems.
- Training.
- Shared saving schemes.
- A building energy efficiency code.

For each of these initiatives the target audience will vary, as will the method of promotion .

²¹ Reports no 8 through 14 during PEEB, 1990-1993.

New Products

86. While the existing information is suitably packaged, it is timely to consider the next stage in the development of building energy efficiency. As major plant improvements are unlikely in the foreseeable future due to scarce resources, the practical option is therefore improved control.

87. BEE is interested in BEMS for air-condition control. However, before BEMS becomes widespread, there should be a credible equipment supply industry to market, service and support users, provide guidance and advise on system feasibility and design. Appropriate BEMS demonstration could be on a large office building in a university campus, and a large hotel.

Promotional Strategy

88. The objective of a marketing strategy in energy efficiency promotion is the building of users' confidence, which leads to careful and well planned investment of scarce management and capital resources.

89. ETSU has proposed the following strategies:²²

- Market research of potential users of the above mentioned products in major public and private building sectors;
- Initiation and development of a dialogue with existing and potential equipment suppliers;
- Preparation of case study materials and guidance from pilot projects with dissemination;
- Development of suitable portfolio of additional projects to cover the principal technologies and key market sectors;
- Research the suitability of evidence from other national programs.

²² Case Study - Cote D'Ivoire Building Efficiency Energy Project, ETSU, March 1993.

APPENDIX
Board 1 - Summary of Recommendations of Technical Report

Action	Owner	Operator	Date	Resources
* Institutional Measures				
Put in place and institutionalize the Committee of Orientation in the control of energy (COME).		BEE	1994	
Propose many decisions governing the output of obligations: (i) Establish a diagnostic of energy management committee (EMCs) to work on energy efficiency in the principal buildings (ii) the preliminary consultation of COME in the case of investment for the installation of energy efficiency.	MEF COME	COME LBTP	1994 1994	BSIE FEM
Fix an objective of consumption to each account of the public sector and define a mechanism to follow in relation with the data base.	MEF COME	LBTP	1994	BSIE FEM
Integrate the engineers formed by PEEB in the structure of the operation.	COME	LBTP DCGTX	1994	
* Control of Energy in Existing Buildings				
Complete the fundamentals of method of disseminating information on public buildings, based on consumption and characteristics of the envelopes, the equipment and the maintenance.	COME	LBTP	1994	BSIE FEM
Create a diagnostic function on the buildings in the public sector.	COME	LBTP		
Prepare and test the methodology of diagnostics based on the criteria of the code.	COME	LBTP ENSTP	1994	BSIE FEM
Attend to the actions of the formation on the basis of the modules existing and develop new modules specialized to understand the action of formation of the private sector.	COME	BEE LBTP ENSTP INSET	1994	FDFB FEM IEPF
Establish investment pilot projects and study the measures of the cases with weak return on investment	COME	LBTP BEE	1994/95	BSIE FEM ADEME CFD, BAD

Action	Owner	Operator	Date	Resources
* Elaboration and Application of the Code of Quality Energy in Buildings				
Attend to the work of finalizing the codes (code, guides and economic study) by mobilizing the steering committees of working groups.	COME	BEE LBTP ENSTP	1994	FEM ADEME
Create a study to thoroughly examine the national and regional market of equipment and material for energy economy and the way to finalize the economical studies and justification of the criteria of the code.	COME		1994	FEM ADEME
Evaluate the first version of the code of quality energy by application of systems to new construction projects in the domain of the application	COME	DCU LBTP ENSTP DCGTX	1994/95	FEM
Organize a workshop of short duration to sensitize decision makers, officials and architects to the well founded recommendations of the code.	COME	ENSTP	1994/95	FEM ADEME
Put the project of the code of quality energy in buildings under public examination.	COME	CODI- NORM	1995	
Define the procedures of agreement for officers of energy control to carry out the burden of verification of conformity of the project to the code.	MECU	DCU	1995	
Designate a judicial officer for the application of the code.	MECU	DCU	1995	FEM
Impose the application of the code in all the public projects	MECU	DCU DCGTX	1995	
Programulate the codes in all the public projects.	MECU	DCU	1997	
* Complementary Actions				
Implicate the control of energy in the next reform of taxes.	COME MME	BEE DCGTX	1994	BIRD FEM
Attend to and develop the activities of standardization of equipment (air conditioners, refridgerators and lights).	CODI- NORM COME	BEE ENSTP INSET LANEMA	1994	FEM
Put in place the arrangement of fiscal specification on materials for energy economy.	MEF COME	COME BEE	1994	FEM

Action	Owner	Operator	Date	Resources
Put in the open a program of education to sensitize students in primary and secondary schools in energy economy.	MEN COME	BEE	1994	FEM
Encourage the energy companies to utilize the management of demand of energy as a component for the development of the electrical sector.	BEE COME	CIE EECI	1995	FEM
Define and disseminate a program of energy economy on public lighting by rationalization of the implementation of the lamps and substitution of the sources.	EECI COME	BEE CIE EECI	1994	BAD CFD ELEC. SECTOR

Joint UNDP/World Bank
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
SUB-SAHARAN AFRICA (AFR)			
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89--	
	Francophone Household Energy Workshop (French)	08/89	103/89
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	--
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessment (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy The Case of N'djamena (French)	12/93	160/94
Comoros	Energy Assessment (English and French)	01/88	7104-COM
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings	09/95	175/95
Ethiopia	Energy Assessment (English)	07/84	4741-ET

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Ethiopia	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
Gabon	Energy Assessment (English)	07/88	6915-GA
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	--
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
Namibia	Energy Assessment (English)	03/93	11320-NAM
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Republic of South Africa	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Energy Assessment (English and French)	07/91	8017-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Vol. I-IV (English)	12/93	--
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Republic of South Africa	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
Uganda	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
Zambia	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Petroleum Management Assistance (English)	12/89	109/89
	Power Sector Management Institution Building (English)	09/89	--
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	--
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP)	12/94	--
	EAST ASIA AND PACIFIC (EAP)		
Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
	Energy Conservation Study (English)	08/94	--
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979/SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy-Issues and Options (English)	01/94	161/94
	Power Sector Reform and Restructuring in Vietnam: Final Report to the Steering Committee (English and Vietnamese)	09/95	174/95
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
SOUTH ASIA (SAS)			
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English)	12/88	
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English)	05/88	--

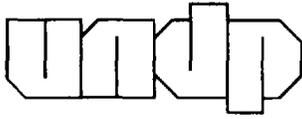
<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Pakistan	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
Pakistan	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	--
	Managing the Energy Transition (English)	10/94	--
	Lighting Efficiency Improvement Program Phase 1: Commercial Buildings Five Year Plan (English)	10/94	--
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86
EUROPE AND CENTRAL ASIA (ECA)			
Eastern Europe	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
Portugal	Energy Assessment (English)	04/84	4824-PO
Turkey	Energy Assessment (English)	03/83	3877-TU
MIDDLE EAST AND NORTH AFRICA (MNA)			
Morocco	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
	Energy Sector Institutional Development Study (English and French)	05/95	173/95
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector(English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91
LATIN AMERICA AND THE CARIBBEAN (LAC)			
LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	National Energy Plan (Spanish)	08/91	131/91
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	Private Power Generation and Transmission (English)	01/92	137/91

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
	Household Rural Energy Strategy (English and Spanish)	01/94	162/94
	Natural Gas Sector Policies and Issues (English and Spanish)	12/93	164/93

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Brazil	Energy Efficiency & Conservation: Strategic Partnership for Energy Efficiency in Brazil (English)	01/95	170/95
Chile	Energy Sector Review (English)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
	Power Sector Restructuring (English)	11/94	169/94
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--
	Energy Pricing Subsidies and Interfuel Substitution (English)	08/94	11798-EC
	Energy Pricing, Poverty and Social Mitigation (English)	08/94	12831-EC
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English)	03/88	--
	Management Information System Phase I (English)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88
	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
Panama	Power System Efficiency Study (English)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English)	09/85	--
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (English and Spanish)	12/90	--
	Study of Energy Taxation and Liberalization of the Hydrocarbons Sector (English and Spanish)	120/93	159/93
Saint Lucia	Energy Assessment (English)	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
Trinidad and Tobago	Energy Assessment (English)	12/85	5930-TR

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	GLOBAL		
	Energy End Use Efficiency: Research and Strategy (English)	11/89	--
	Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	--
	Women and Energy--A Resource Guide		
	The International Network: Policies and Experience (English)	04/90	--
	Assessment of Personal Computer Models for Energy Planning in Developing Countries (English)	10/91	--
	Long-Term Gas Contracts Principles and Applications (English)	02/93	152/93
	Comparative Behavior of Firms Under Public and Private Ownership (English)	05/93	155/93
	Development of Regional Electric Power Networks (English)	10/94	--
	Roundtable on Energy Efficiency (English)	02/95	171/95

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